

What is claimed is:

- 1 1. A hybrid vehicle that is traction powered by an internal combustion engine and an
2 electric motor powered by a fuel cell system, the hybrid vehicle's drive system
3 comprising:
 - 4 a) the electric motor being combined with a driveshaft that is also driven by
5 the internal combustion engine via a transmission; and
 - 6 b) a computer controller establishing values of power delivered to the
7 electric motor from the fuel cell system to rotate the driveshaft
8 independently or in combination with internal combustion engine,
9 depending on vehicle traction drive demands.
- 1 2. The hybrid vehicle of claim 1, wherein the fuel cell system delivers both peak and mean
2 power to the electric motor without the need of an electricity storage device
3 (traction battery).
- 1 3. The hybrid vehicle of claim 1, wherein the internal combustion engine and the fuel cell
2 system are powered by the same fuel.
- 1 4. The hybrid vehicle of claim 1, wherein the exhaust of fuel cell system is fed back into
2 an intake of the internal combustion engine.
- 1 5. The hybrid vehicle of claim 1, wherein the fuel cell system includes a Solid Oxide Fuel
2 Cell (SOFC).
- 1 6. The hybrid vehicle of claim 5, wherein exhaust from the internal combustion engine
2 provides heat to the SOFC.
- 1 7. The hybrid vehicle of claim 1, wherein the electric motor has a rotor coaxial with the
2 driveshaft and a stator fixed to the vehicle frame.
- 1 8. A hybrid vehicle having an internal combustion engine and an electric motor powered
2 by a fuel cell system each arranged as a traction power source, the vehicle
3 comprising:

- a) a driveshaft rotated by the internal combustion engine, wherein the driveshaft includes a rotor of the electric motor; and
- b) a stator of the motor surrounds the rotor and is fixed to the vehicle; and
- c) a fuel cell system provides peak power to the motor without the need of an electricity storage device; and
- d) the fuel cell system can rotate the driveshaft independently of the internal combustion engine or in combination with the internal combustion engine.

9. The vehicle of claim 8, wherein the internal combustion engine and the fuel cell system are powered by the same fuel.

10. The vehicle of claim 8, wherein the fuel cell system includes a SOFC.

11. The vehicle of claim 10, wherein exhaust from the fuel cell system is fed to an intake of the internal combustion engine.

12. The method of claim 10, wherein exhaust from the internal combustion engine provides heat to the SOFC.

13. A method of operating a traction drive of a hybrid vehicle having an internal combustion engine, a transmission, a driveshaft and a driven wheel, the method comprising:

- a) arranging a rotor of an electric motor in the driveshaft so that a stator of the motor surrounds the driveshaft; and
- b) powering the electric motor with a fuel cell system unaided by an electricity storage device; and
- c) using a computer controller to control the electric motor and the internal combustion engine so that the electric motor can rotate the driveshaft alone or with the internal combustion engine, depending on vehicle traction drive demands.

1 14. The method of claim 13, including powering the internal combustion engine and the
2 fuel cell system with the same fuel.

1 15. The method of claim 13, including feeding an exhaust from the fuel cell system to an
2 intake of the internal combustion engine.

1 16. The method of claim 13, wherein fuel cell system uses a Solid Oxide Fuel Cell
2 (SOFC).

1 17. The method of claim 16, wherein and exhaust from internal combustion engine
2 provides heat to the SOFC.

1 18. The method of claim 13, wherein the computer controller, electric motor, driveshaft
2 and fuel cell system are retrofitted into a vehicle already having an internal
3 combustion engine.

1 19. A method of retrofitting a vehicle having an internal combustion engine, transmission,
2 driveshaft, driven wheel, and fuel supply, the method comprising:

3 a) adding a fuel cell system powered by the fuel supply; and

4 b) replacing the driveshaft with a retrofit driveshaft that includes an electric
5 motor; and

6 c) powering the electric motor solely with the fuel cell system to rotate the
7 retrofit driveshaft; and

8 d) using a computer controller to control the electric motor so that the
9 electric motor can rotate the driveshaft alone or with the internal
10 combustion engine, depending on vehicle traction drive demands.

1 20. The method of claim 19, wherein the fuel cell system uses a Solid Oxide Fuel Cell
2 (SOFC).

1 21. The method of claim 20, wherein the exhaust from internal combustion engine
2 provides heat to the SOFC.

- 1 22. The method of claim 19, including feeding an exhaust from the fuel cell system to an
- 2 intake of the internal combustion engine.